

Coal's Role In Energy Security ... The Bridge To Renewables

Department of Energy
Hydrogen Workshop
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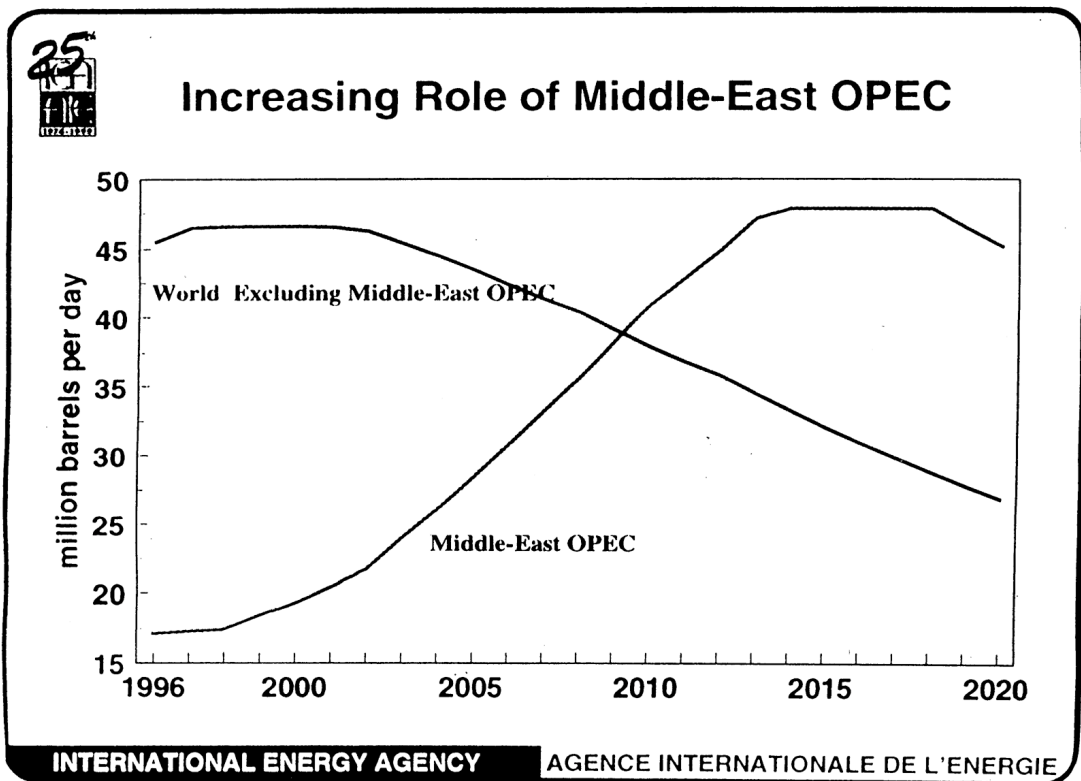
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Increasing Role of Middle-East OPEC

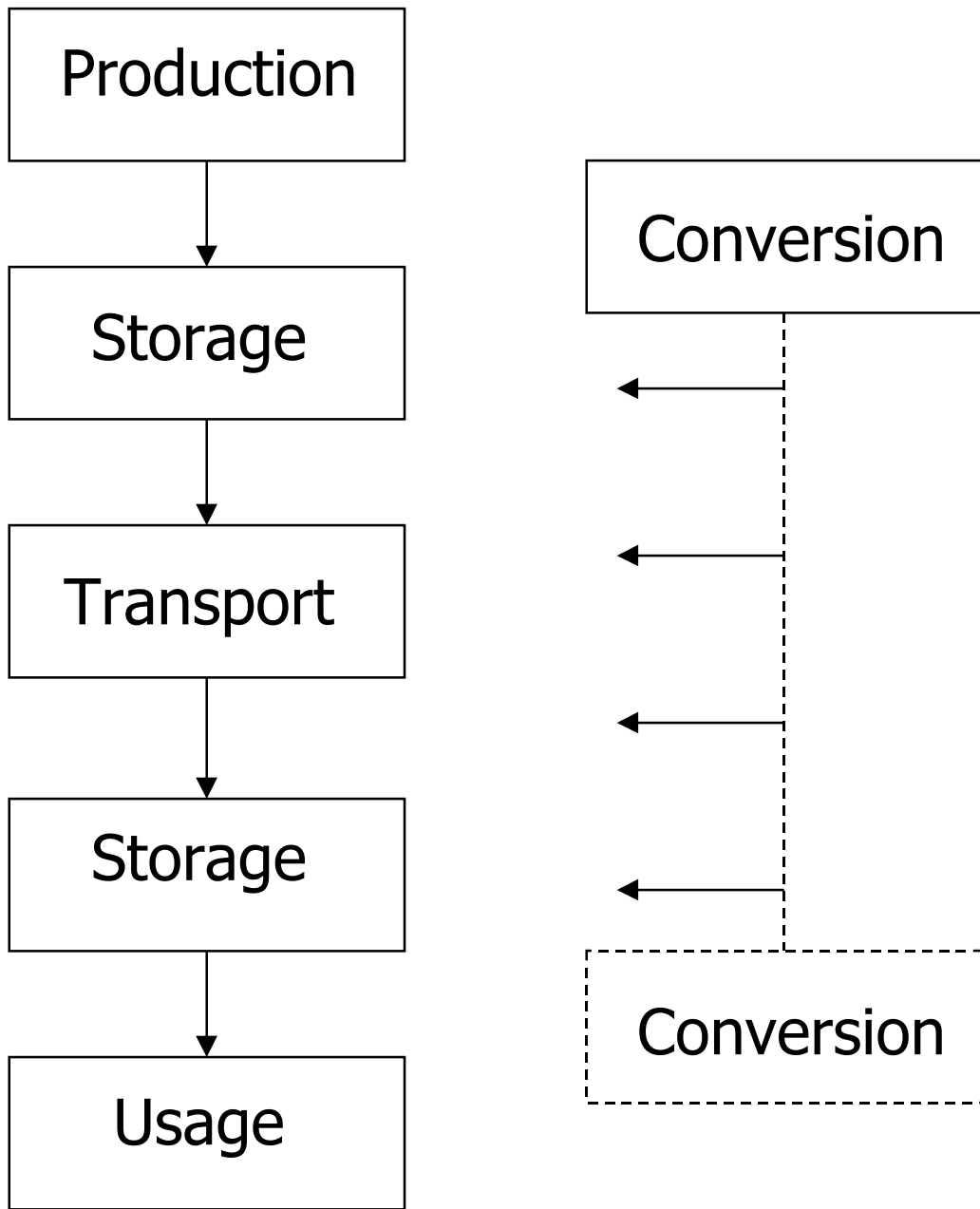


Coal's Attributes

- Large Reserves
- Geographically Diverse
- "Conflict Free" Energy Source
- Low Cost Energy
- Utilizes Existing Infrastructure
- Burns Cleanly With Technology



Energy Production/Usage Chain



Energy Prices

Today Vs. One Year Ago

			<u>\$Unit</u>	
<u>\$/MMBtu</u>			1 Yr.	
1 Yr.	%		<u>Today</u>	<u>Ago</u>
<u>Today</u>	<u>Ago</u>	<u>Inc.</u>		
Henry Hub Gas (MMBtu) ¹			5.10	2.47
5.10	2.47	106		
Fuel Oil No. 2 (Gallon) ¹			1.00	0.61
7.19	4.38	64		
Brent Crude (Barrel) ¹			31.05	23.08
5.35	3.97	35		
Pittsburgh Seam Coal (Ton) ²			25.00	23.25
0.96	0.89	8		
Powder River Basin Coal (Ton) ²			4.70	4.85
0.27	0.28	(3)		



¹ Wall Street Journal Sept. 15, 2000

² Coal Outlook Sept. 18, 2000

Raw Cost of Hydrogen* From Fossil Fuels

C-H ₄	C-H	C-H ₂	
<u>Natural Gas</u>	<u>Coal</u>	<u>Petroleum</u>	
Contribution of H ₂ to Heating Value 54%	23%	37%	
Price - \$/Unit	25/Ton	15/bbl	30/bbl
3/Mcf 6/Mcf			
\$/MMBtu	1.00	2.60	5.20
3.00 6.00			
Cost of Hydrogen - \$/MMBtu	4.30	7.00	14.00
5.50 11.00			

*Magically assumes no processing costs and no conversion losses



Recommendations For "Roadmap" Hydrogen Production/Usage

Implementation

- Decarbonized fuel from coal should have tremendous appeal on "both sides of the aisle" because of its energy security and environmental virtues.
- Electricity generation from clean, efficient combustion of coal-fired power plants; hydrogen production from coal with CO₂ sequestration; and natural gas for distributive uses is the rational portfolio strategy.
- Coal is the logical source of energy as a transitional fuel to the eventual goal of H₂ from renewables.
- Steam reforming of synthetic gas from coal to produce H₂ will cap natural gas prices, until electrolysis of H₂O from sunlight caps both.



Recommendations For "Roadmap" Hydrogen Production/Usage

Process Technology

- Research efforts, especially in areas of production and sequestration, need to be stepped-up.
- The primary focus should be on process development. The private sector will take care of storage, transport and usage -- if H₂ can be made competitive with natural gas.
- The natural gas/coal price spread versus the cost of H₂ from coal will determine the success of the program.
- The coal industry stands ready to provide a low cost, secure feedstock for H₂ production.
- Unmineable coal seams should be considered for coalbed methane production, methane reformation to H₂, and CO₂ injection for well stimulation.



Recommendations For "Roadmap" Hydrogen Production/Usage

Utilization

- The Mine Safety and Health Administration is exploring the use of hydrogen fuel cells to power mining equipment and to eliminate trolley wire or diesel from underground. The hydrogen would be stored as a metal hydride.

